Roa, Beryl E. **Engineering Economy**

BSME 3C

1.

3.3

a. Juan bought a car with a cashy value of P14,000 on the installment plan under the following terms:

P4, 000 cash upon delivery and the balance payable in 12 equal monthly payments, each payment combining an amortization and 6% on the previously unpaid balance. Solve for his monthly payment.

Given:
A = 14000 – 4000 = 10000
r = 6% /12 = 0.06/12 = 0.005
n = 12

Solution:

$$P_{monthly} = \frac{10{,}000(0.005)(1+0.005)^{12}}{1+0.005^{12}-1} = \frac{53.086}{0.0616} = \mathbf{862}$$

b. At the end of 8 months, he was forced to sell the car in order to pay a P7, 000 debt. At what price must he sell his car so that he can completely pay the car and also pay his P7, 000 debt?

After 8 months of payment, 6896.55 would be paid out of 10000. Left amount to cover the loan is 3103.44.

Additionally Juan needs 7000.

Thus, Juan must sell his car at 7000 +3103.44 = **P10103.44** to cover the loan of amount as well as his personal debt.

2. To maintain a bridge, P5000 will be required at the end of 3 years and annually thereafter. If money is worth 8%, determine the capitalized cost of all future maintenance.

Solution:

$$P_x = \frac{A}{i} = \frac{5000}{0.08} = 62500 \ \ (after\ 3\ yrs)$$

$$P_x = \frac{F}{(1+i)^n} = \frac{62{,}500}{(1+0.08)^3} = 49{,}614.52\ (starting\ year)$$

$$PV = \frac{5000}{(1+0.08)^3} = 3969.16$$

$$C_c = FC + P_r$$
$$= 49{,}614.52 + 3969.16$$
$$C_c = \mathbf{53{,}583.68}$$

3. A research foundation wishes to set up a trust fund earning 10% compounded annually to
   a. Provide P2,000,000 for the lot and building and P1,000,000 for the initial equipment of a structural Engineering and materials laboratory
   b. Pay P400,000 for the annual operating cost every year and
   c. Pay P500,000 for the purchase of new equipment and replacement of some equipment every 5 years beginning 5 years from now.
   How much money is needed to be put in the fund for the building and equipment replacement?

   Given Data:

   Cost of lot and building = 2,000,000
   Cost of Equipment = 1,000,000
   Annual Operating Costs = 400,000
   Replacement cost at the end of year 5 = 500,000
   Rate of Interest = 10% per annum

   Solution:

$$Present\ worth\ P = \frac{F}{(1+i)^n}$$

$$Present\ worth\ P = F\left(\frac{P}{A}, in\right) = F\left[\frac{(1+i)^n - 1}{i(1+i)^n}\right]$$

Present worth of replacement cost,

$$P_1 = \frac{500{,}000}{(1+0.1)^5} = \mathbf{310{,}466.66}$$

Present worth of annual operating charges,

$$P_2 = 400{,}000 \times \left[\frac{(1+0.1)^5 - 1}{0.1 \times (1+0.1)^5}\right] = \mathbf{1{,}516{,}314.71}$$

$$Total\ money\ required = 2{,}000{,}000 + 1{,}000{,}000 + 310{,}466.66 + 1{,}516{,}314.71 = \mathbf{4{,}826{,}775.37}$$

4.

2.3 The purchaser of a tractor paid P10,000 cash and agreed to pay P3000 at the end of 6 months for 10 years. He failed to make the first 5 payments of P3000 each. At the end of 3 years he desires to pay the tractor by a single payment which will cancel both his accumulated liabilities and his future liabilities. What must he pay if money is worth 6% per annum compounded semi-annually?

Given:
n = 2(10-3) =14
i = r/m =0.06/2 = 0.03
A = P3000

Solution:

$$P_1 = A\left[\frac{1-(1+i)^{-n}}{i}\right]$$
$$P_1 = 3000\left[\frac{1-(1+0.03)^{-14}}{.03}\right]$$
$$P_1 = P\ 33\ 888.21942$$
$$P_2 = 3000(6) = P\ 18\ 000$$

$$Total\ Payment = P_1 + P_2$$
$$Total\ Payment = P\ 33\ 888.21942 + P\ 18\ 000$$
$$Total\ Payment = \mathbf{P\ 51\ 888.21942}$$

2. 4 A man wishes to provide a fund for his retirement such that from his 60th to 70th birthdays he will be able to withdraw equal sums of P18,000 each for his yearly expenses. He invests equal amounts from his 41st to 59th birthdays in a fund earning 10% compounded annually. How much should each of these amounts be?

Given:
A_1 = P 18 000
n_1 = 11
n_2 = 19
i = 10% (annually)

Solution:

$$A_1\left[\frac{1-(1+i)^{-n_1}}{i}\right] = A_2\left[\frac{1-(1+i)^{-n_2}}{i}\right](1+i)^{-n_1}$$

$$A_1\left[\frac{1-(1+.10)^{-19}}{.10}\right] = 18{,}000\left[\frac{1-(1+.10)^{-11}}{.10}\right](1+.10)^{-19}$$

$$A_1 = 2{,}285$$
$$Amount\ invested\ from\ 41st - 59th\ birthday = \mathbf{P2\ 285.00}$$